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Abstract

A new species of satyrid butterfly, *Calisto tasajera*, is described from the southern Cordillera Central in the República Dominicana. Explanations are given for the distributions of some species of *Calisto* in this region, and a précis of the high (above 2000 m) mountains is supplied for further investigation.

Introduction

The speciose satyrid genus *Calisto* is represented on Hispaniola by 35 species (Schwartz, 1989). These fall into several natural groupings (Gonzalez and Schwartz, MS). One of these groups is the *lyceia* complex, which includes a series of species whose undersides are red to bright orange and which occur from sea level to moderate elevations in the República Dominicana. All have apparently rigorous habitat requirements, namely xeric areas (including pine forest) with some species of tussocky or bunch grass. The species include (with their known ranges): *lyceia* Bates, 1935 (Isla Saona, Isla Catalina); *crypta* Gali, 1985 (western Valle de Cibao and associated extreme northern foothills of the Cordillera Central); *franciscoi* Gali, 1985 (Valle de Neiba, Llanos de Azua; Península de Barahona); *hendersoni* Gali, 1985 (Valle de Neiba); *raburni* Gali, 1985 (519-580 m, Massif de la Selle); and *schwartzi* Gali, 1985 (1251-1373 m, Sierra de Baoruco; Schwartz, 1989).

The *lyceia* complex is thus known from the former north and south islands. On the north island and its satellites (Isla Catalina, Isla Saona), the species involved are almost exclusively inhabitants of arid lowland elevations with tussocky grass (usually *Uniola virgata*). But on the south island, the species occur not only in that habitat but also at moderate elevations in the extreme eastern Massif de la Selle (*raburni*) and Sierra de Baoruco (*schwartzi*). In the latter case, the habitat is another species of tussocky grass in pine forest, where the butterflies are often abundant. There has been no species of the *lyceia* complex known from the Dominican Cordillera Central, except for its northernmost lower slopes where *C. crypta* occurs locally.

Wetherbee, while a resident at the villages of Bohechío and Sabaneta in Provincia de San Juan and El Rubio in Provincia de Santiago, made several (often arduous) excursions by jeep, mule, and foot to some of the southwestern ranges of the Cordillera Central; these ranges lie more or less along the Elías Piña-San Juan and Azua-San Juan province lines and within Santiago itself. His collecting there has revealed the most southwestern populations of *Calisto arcas*, a species previously known only from the area above Constanza and Pico Duarte, some 30 km to the east, as well as a low elevation population of *C. elelea*, a species known from the highlands of the south island Massif de la Selle and Sierra de Baoruco and also from one population on the Cordillera Central (at Los Guandules, Prov. de Dajabón; see Schwartz, 1989:442-445 for details). He also secured fine series of some as yet unnamed members of the *grannus* complex (Gonzalez, 1987), a complex of moderate to high elevation species that centers in the Cordillera Central. Additionally, he collected a fine series of a new species of the *lyceia* complex (apparently most closely related to *C. schwartzi*), first taken on Loma de Tasajera, about 13 km S of Pico Duarte, in these southwestern ranges, and later at four other localities. Like *C. schwartzi*, this new species occurs in the uplands and is distinctive in size, color, and pattern details. For it we propose the name:

Calisto tasajera, new species
Figs. 1 and 2.

Males. FW (forewing) length 17.0-21.0 [all measurements in millimeters], $x = 15.0$; $N = 34$); UPFW (upper side forewing) and UPHW (upper side hindwing) dark brown (Pl. 16A12; all color designations from Maerz and Paul, 1950); androconial patch large, covering all but marginal one-quarter of UPFW, its outer margin more or less paralleling outer margin of FW; UN (underside) deep reddish brown (Pl. 6I11, Pl. 7L11, Pl. 8L9), somewhat paler distad to postdiscal line; UNFW with brown marginal and submarginal lines and faint postdiscal brown line; a large black round to subcircular ocellus (2.5-3.5; $x = 3.0$) ringed with yellow and with two white "pupils," located in subapical portion of FW, extending from above M1 to below M3, the anterior "pupil" located slightly above the midline of the ocellus, the posterior "pupil" displaced onto the yellow ring; UNHW without prominent discal line; a large strongly ovate black UNHW ocellus ringed with yellow (1.7-3.5; $x = 2.6$) in Cu1-Cu2 with a single white "pupil" on yellow ring and occasionally with a faint gray central "pupil"; a small ocellus in Cu2-2A with a white basal "pupil" on yellow ring anteriorly; two white dots in M1-M2 and M2-M3, the latter much the larger and often "smeared"; anal lobe (in 2A-3A) on both UPHW and UNHW black with a superior yellow line.

Females. FW length 19.0-22.0 ($x = 20.4$, $N = 13$); UP dark brown like males; UN like males; UNFW ocellus 2.6-4.0 ($x = 3.3$), with the posterior white dot touching yellow ring; details of UNHW color and pattern like males, but both large and accessory small ocelli more frequently with, in addition to white marginal "pupil," a faint grayish central "pupil"; UNHW ocellus 2.1-3.5, $x = 2.4$.

HOLOTYPE male: REPUBLICA DOMINICANA: PROVINCIA DE SAN JUAN: Loma de Tasajera, 2142 m; 28-29.xi.1989 (D.K. Wetherbee), ex colln. A. Schwartz, now in collection of the Milwaukee Public Museum. Original number AS 25033.

PARATYPES (AS = Albert Schwartz collection): AS 25031, AS 25032, AS 25035, AS 25052 (males), AS 25034, AS 25043 (females): same data as holotype; AS 25747, AS 25766, AS 25824, AS 25825, AS 25827, AS 25832, AS 25833, AS 25834, AS 25836, AS 25838, AS 25839, AS 25840, AS 25881 (males), AS 25746, AS 25748, AS 25749, AS 25826, AS 25827, AS 25830, AS 25837 (females): R.D.: San Juan: Loma Pinal Viejo (El Manguito), 29.v-1.vi.1990, D.K. Wetherbee; AS 25891, AS 25893, AS 25922, AS 25923, AS 25927, AS 25928, AS 25955 (males), AS 25893, AS 25949, AS 25951, AS 25952 (females): R.D.: San Juan-Santiago: Aguita Fria, base of Loma la Diferencia, 1750-2300 m, 20.vii.1990; AS 25898, AS 25930, AS 25931, AS 25932, AS 25960, AS 25966, AS 25973, AS 25975, AS 25976 (males): R.D.: San Juan-Santiago: Loma la Diferencia, peak, 2300-2800 m, 21.vii.1990; AS 26677 (male): R.D.: Santiago: Pico Platico, 1200-2500 m, 26.-30.vii.1990.

ETYMOLOGY: The trivial name is that of the montane range upon which the type-locality lies.

COMPARISONS: *Calisto tasajera* hardly requires comparison with other members of the *lyceia* complex or, for that matter, with other Hispaniolan *Calisto*. In size, *C. tasajera* is larger than *C. lyceia*, *C. franciscoi*, *C. hendersoni*, and *C. schwartzi*, and about the same size as *C. raburni* and *C. crypta*. From all these *lyceia* complex members, *C. tasajera* differs in the depth of the UN pigmentation, presence of only two (rather than four) dots on the UNHW (two dots in *C. raburni*), and the presence of a small but constant "complete" ocellus in UNHW Cu2-2A (see Gali, 1985:14, for color photographs of all included species). The only other Hispaniolan species that is phenotypically similar to *C. tasajera* is *C. pulchella*, but that species is much larger (FW males 19-24, females 22-28) and differs not only in habitat and distribution but also very strongly in male genitalia (*C. pulchella* is one of only two Hispaniolan *Calisto* that have quite different

male genitalia from all other Hispaniolan members of the genus).

GENITALIA: The male genitalia may be described thus (see also Fig. 2). The uncus is of the typical bird's head shape of most Hispaniolan *Calisto*, its upper face slightly bowed; the pretegumental groove is deep and the tegumen itself is arched. The gnathoi are long. The vinculum is more or less straight and thin, whereas the saccus is short and somewhat hooked dorsally at its terminus. The valvae are short, distinctly hooked anteriorly and pointed posteriorly, with a central dorsal pointed "process" (see Gali, 1985:13, for illustrations of the male genitalia of all members of the group); the valvae of *C. tasajera* are similar to those of *C. crypta*, with a strong doubly concave dorsal aspect. The penis is short and straight.

REMARKS: The topotypical series of *C. tasajera* was taken above 2000 m. The habitat is thick dry grass (*Danthonia domingensis*) and ferns with scattered living *Pinus occidentalis*, often charred (see below). Collection was simplest by standing in the mule path and watching in both directions. Sooner or later, one of these large dark butterflies would appear and start to follow the path where they were easily caught. When the butterflies were over the ferns and grasses, they flew (usually only in sunshine) in rather long vertical arcs, not parallel to the ground.

The same general habitat data apply to all other localities except Pico Platino. *Calisto tasajera* is not common there, since, rather than grassy areas, one encounters dense growth of sedges, mosses, and lycopods to a depth of 0.6 m. Thus the "rarity" of *C. tasajera* there may be due to the uncommonness of its "normal" habitat.

Calisto tasajera has the highest elevational distribution of any of the *lyceia* complex, from 2000 m to 2800 m; no other species of the complex approaches these elevations, the highest being 1251-1373 m for *C. schwartzi*.

As one encounters in the field unique *Calisto* populations on one mountain or another, one is moved to contemplate biogeographic explanations for the evolution of this speciose genus. Thirty-five species have already been described from the "small" island of Hispaniola, and many others await discovery, especially in the unexplored mountains.

We would suppose that three factors are chiefly responsible for this proliferation of forms: (1) the well-known sedentary habits of *Calisto* in their grassy habitats, (2) dispersal by autumnal Caribbean hurricanes; (3) geographic isolation (and extinctions) by prehistoric and historic ubiquitous grass and brush fires caused by lightning striking *Pinus occidentalis*, and by traditional land-burning for agriculture. (We are aware that Brown [1978:12-13] is disinclined to use hurricane-transport as a method for moving butterflies from island to island, and we agree with him, but we are talking here of much lesser distances and no or very rare overwater transport.)

Four examples of unique *Calisto* populations with which Wetherbee has had field experience are: *Calisto wetherbeeii* Schwartz and Gonzalez on the top of Loma Nalga de Maco (Provincia de Elías Piña), *C. elelea* Bates on neighboring Loma los Guandules, a population of *C. galii* Schwartz on isolated Mont Griné (perhaps more properly spelled, in Haitian Creole, Mon Grinnié; Département du Nord-Est, Haiti), and *C. tasajera* on top of another outlier of the Cordillera Central in Provincia de San Juan.

The first of these is apparently unique to the asbestos forest on the summit of isolated cloud-shrouded Nalga de Maco. The second species, with a population on Guandules (near Guayajayaco, R.D.), has been previously known only from far away Massif de la Selle and Sierra de Baoruco on the paleo-south island. The third species, *C. galii*, widespread in the Cordillera Central in the República

Dominicana, was found on isolated Mont Griné; this was the first record for Haiti. This population occurs in a small patch of presently neglected woody habitat atop the mountain, an isolated habitat in the generally scalped flammable landscape of the country. The fourth species, *C. tasajera*, was found on top of a high outlier of the Cordillera Central in the Provincia de San Juan.

The occurrence of tropical hurricanes on Hispaniola is too well-known to dwell upon. A brief synopsis of recent hurricanes is in Schwartz, 1989:6. As they are spiral, they disperse whatever they pick up in any and all directions and for long distances.

Fires are so common in the Cordillera Central (and in the Sierra de Baoruco; Schwartz, 1989:498-500) that one can often see a dozen fires at once at various points of the compass during the dry seasons. Many of these fires are set purposely in the traditional practice of preparing land for agriculture. This practice had been pursued for at least 2000 years on Hispaniola. Many other fires are set (and have been for millions of years) by the almost daily (seasonal) electric storms. Endemic *Pinus occidentalis*, the pitchy dead wood ("guava") of which is highly inflammable, is a natural kindling. The living trees, abundantly killed by direct lightning strikes, are extremely forest-fire tolerant (perhaps even fire-dependent, as are some other species of pine). The montane *Calisto* habitats of dense grass and ferns are intimately associated with the charred but still living pines.

The Nalga de Maco population of *C. wetherbeei* is undoubtedly an ancient sedentary one in the wet broadleaf elfin climax-forest of that isolated outlier. The Nalga de Maco population may well be the only population of the species.

The Guandules population of *C. elelea* has logical candidacy as a hurricane transplant from the Hispaniolan south island, a transplant that could happen anywhere and probably has occurred elsewhere, until eliminated by fire. We would consider the small Guandules population to be a temporary one, a naturally endangered population extremely vulnerable to fire.

The Mont Griné population of *C. galii* also has strong candidacy as a hurricane transplant from the Cordillera Central. It is inconceivable that Mont Griné's small patch of disturbed woody habitat is virgin forest, spared for hundreds of years by the scalping land practices of the Haitians. The nearest known population of *C. galii* is on distant Nalga de Maco, beyond any reasonable flying distance for a *Calisto*. A relictual status for this population would not be a conservative estimate.

The habitat of *C. tasajera* is a paradigm of pyrogenesis: thick, dry grass and ferns with scattered living *Pinus occidentalis*, often charred - a veritable tinderbox. Wetherbee has seen fires out of control on Loma de Tasajera that burned for days with conflagrations in the dense grasses of truly awesome proportions.

In conclusion, the sedentary habits, hurricane vulnerability, and fire vulnerability seem adequate reasons for postulating that the genus *Calisto* on Hispaniola is at the mercy of this unique combination of evolutionary vectors. The isolated populations, repeatedly reduced by fire to very few individuals, further would enhance the speed of speciation from laboratory-sized gene pools. The ventral view of the holotype of *C. tasajera* is the work of Susan Borkin, and we are grateful to her.

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Appendix

PRÉCIS OF THE CORDILLERA CENTRAL IN THE REPÚBLICA DOMINICANA

The Cordillera Central of the República Dominicana is a last frontier for zoological and botanical exploration in that country. It has remained largely unexplored by biologists because of the rarity of vehicular ways above 1000 m. There are, however, ancient Amerindian trails throughout the mountains, and an astonishing number of *campesinos* live far in the hinterland.

The Cordillera extends as a southeast to northwest upland from San José de Ocoa to the Haitian border at Restauración (and continues into Haiti as the not exceptionally high [1200 m, Pic Brigand, Dépt. du Nord; Pereira, no date. Géographie d'Haiti. Imprimerie N. A. Théodore, Port-au-Prince], Massif du Nord), but the more formidable part of it is concentrated in the eastern and central portions (U.S. Army Topographic Command. 1968. Topographic quadrangles of the Dominican Republic. Ser. E733. Scale 1:50,000). The more easterly of these massifs, which may be called the Quéliz Massif, has been investigated more than the central-western one (which may be called the Lamedero Massif) because of the road from San José de Ocoa to Constanza that has its main course passing as high as 2450 m. This road has a spur to the highest peak in the Quéliz Massif, Bandero (2842 m). Animal and plant collectors have had an easy time of it here, indeed.

The Lamedero Massif, in contrast, has been investigated only in its eastern parts, where Pico Duarte (3175 m) and Loma Rucilla (3045 m), the highest ground in the West Indies, have been a focus of curiosity in spite of lack of vehicular roads. The two massifs are separated roughly by the headwaters of the two Ríos Yaque, Norte and Sur. The intervening land, all below 2000 m, is not very low, however, and would not have constituted any barrier to high montane animal dispersal during the Pleistocene. The explorations of the Quéliz massif, therefore, have served to make known many, if not most, of the vertebrates that probably occur in the Lamedero Massif as well. There may well be several reptiles and amphibians yet unknown to science in the Lamedero Massif and its outliers. Many unknown *Calisto* probably await discovery throughout the Cordillera, on its slopes and outliers.

The Cordillera is complex and covers a large area. The would-be explorer finds

it difficult to gain an overview for selecting priority objectives.

Peaks above 2500 m are rare in both massifs. In the Quéliz Massif, besides Bandero (2842 m) in Prov. de la Vega, there are Cigua (2672 m), Guayabal (2640 m), and Pajón Blanco (2659 m) and associated peaks. In the Lamedero Massif are the peaks that separate the *provincias* of Santiago and San Juan: the Pico Duarte (3087 m) complex (including Rucilla [3038 m] and Pelona [3087 m]), Sierra Diferencia - sometimes referred to as Monte Entre los Ríos (República Dominicana's Brasilia) - Central (Viudo, 2801 m, and Medianía, 2707 m), Southern (Baraco, 2654 m), and Northern (Frias and Tambor, 2725 m), plus, wholly in Prov. de Santiago, Palada (Platicos) (2522 m) and, wholly in Prov. de San Juan, Guanós (2561 m). It is unfortunate that the topographic quadrangle, immediately north of the Lamedero quadrangle, was confusingly named "Diferencia." The unexplored uplands west of the Lamedero Massif are very extensive and have much dissection but are lower than 2000 m with the exceptions of Picachos (2322 m), Manguito (Pinal Viejo, Gajo Blanco) (2313 m), and Bandero (2027 m) in Prov. de San Juan. Additionally in this province are some other interesting outliers almost 2000 m in elevation: Pataca (1972 m) and Comíos (1814 m). In Prov. de Elías Piña is far removed Nalga de Maco (1990 m).

While all the above peaks might well be regarded as priority objectives for exploration, in truth most animals that occur above 2500 m and 2000 m also occur below these elevations. New species might be found anywhere.

An exploration into the Cordillera Central is not to be taken lightly, yet, one can almost wager that friendly *campesinos* have clearings and huts on the upper slopes in the most remote and unlikely situations. One soon learns, however, that one stays on the ancient trails, which, for millenia of natural selection have modified the right course. If there is no trail, there is good reason for that.

Ecologically, according to the Holdridge system, the Cordillera Central is subtropical very humid montane forest (often there is no forest left), and subtropical very humid low montane "forest" (Tasaico, H. 1967. Mapa ecológico de la República Dominicana. Org. Est. Amer. Scale 1:250,000). The endemic *Pinus occidentalis* is the ubiquitous woody species on well-drained ground. *Cañadas* often have broadleaf cover. Of very special interest are three small patches of subtropical low montane rainforest southeast of Loma Alto de Bandero. Between the two massifs is another small patch south of Moaboa. In the Lamedero Massif is another small patch on El Manguito (Pinal Viejo). This Holdridge life zone is represented in the República Dominicana by only 36 km² and deserves special exploration. The explorer should keep in mind that the Holdridge system obscures the important fact that a designated life zone often exhibits great seasonal differences in rainfall, and unpredictable extended dry seasons are not to be unexpected in even the "pluvial" forests.

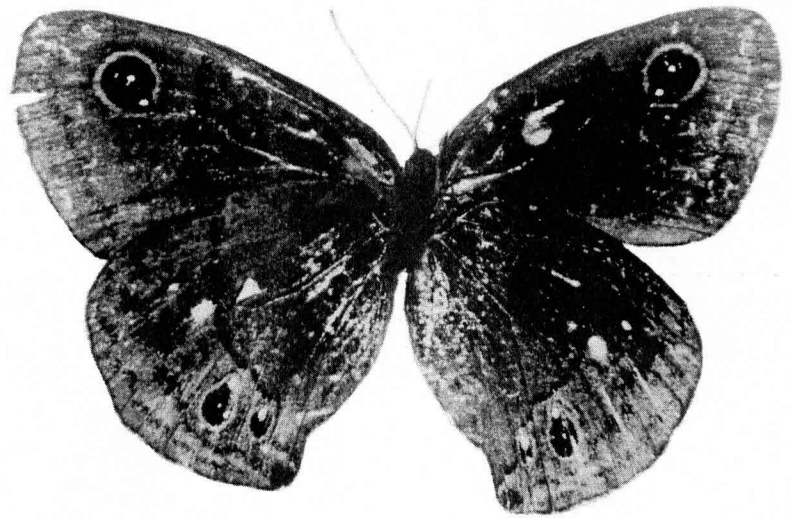


Figure 1. *Calisto tasajera*, male holotype (AS 25033), view of underside.

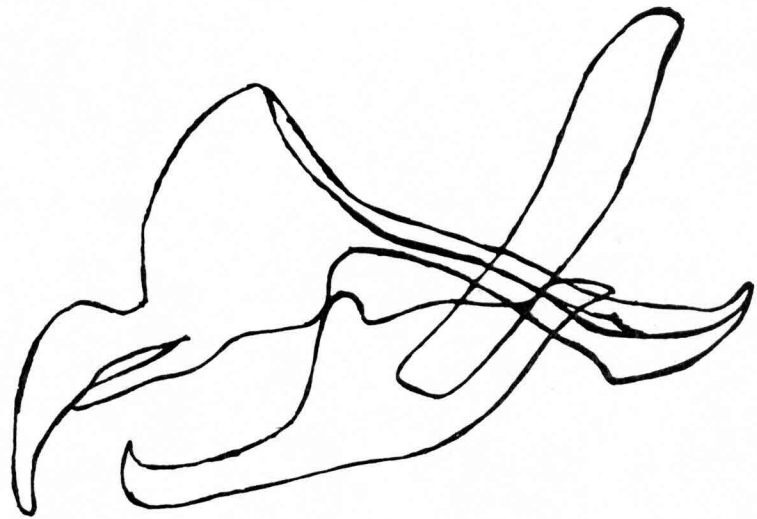


Figure 2. *Calisto tasajera*, male genitalia (AS 25840)